A Survey of Moulting Canada Geese in the Bathurst Inlet and Back River Areas, Northwest Territories

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A SURVEY OF MOULTING CANADA GEESE IN THE BATHURST INLET AND BACK RIVER AREAS, NORTHWEST TERRITORIES

Habitat Management Section

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ABSTRACT

A survey of moulting Canada geese was conducted from 23-28 July, 1984. The objectives of the study were: 1) to determine the distribution and abundance of moulting Canada geese in the vicinity of Bathurst Inlet and along the Hood, James, Burnside, Western, Huikitak, Ellice, and Back rivers, 2) to evaluate the importance of Key Habitat Sites in the study area, 3) to determine the subspecific composition of the moulting flocks, and 4) to record ancillary information on other wildlife in the study area.

A total of 9,697 Canada geese was observed. The approximate distribution was: Back River system - 7893, Ellice River - 1162, Huikitak River - 144, Bathurst Inlet - 106, and inland areas - 362. Approximately 70% of the birds on the Back River system were concentrated within the Middle Back River Key Habitat Site. It is recommended that the Key Habitat Site be extended westward to the junction of the Baillie and Back rivers.

Concentrations of lesser snow geese were recorded at: lower Ellice River - 54, Bullen - Back River junction to the east end of Upper Garry Lake - 467, and lower Back River - 403. This represents the first record of breeding lesser snow geese in the Upper Garry Lakes area.

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1.0 INTRODUCTION

1.1 Key Habitat Sites

The Canadian Wildlife Service (CWS) recently completed a compilation (McCormick et al. 1984) of the key migratory bird terrestrial habitat sites in the Northwest Territories (NWT). Any site which supports at least one percent of the Canadian population of a migratory bird species or subspecies, for any portion of the year, is considered to be a key habitat site. Evaluations are based upon the best available estimates of national and regional populations and the number of individuals present at each site. Some of the site-specific data are out-dated and of variable quality. Sites, therefore, have been ranked with regard to updating the appropriate information and will be systematically surveyed as financial and personnel resources permit.

Actual and potential moulting goose habitats in the Bathurst Inlet and Back River areas are priority survey sites for the following reasons:

1) Available information (Prest et al. 1969) suggests that suitable moulting sites exist along the James, Hood, and Burnside rivers. These rivers have never been surveyed.

2) Similarly, available information (Smith and Sutton 1953, Prest et al. 1969) suggests that there is considerable suitable moulting habitat along the Ellice River. There has been no recent systematic survey of this river.

3) Despite extensive earlier surveys, large areas (Pelly and Garry lakes) of the Back River system, where suitable habitat exists, were inadequately surveyed (Sterling and Dzubin 1967).

4) Although a number of surveys have been conducted in the lower Back River (McLaren et al. 1976, 1977; Zdan and Brackett 1977; Allen and Hogg 1978), there has been no survey of the complete Back River system for over 15 years.

5) There has been a 35% increase in the total continental Canada Goose population since 1972. Most of the populations which moult in the NWT have also increased (Anon. 1973, Anon. 1985).

1.2 Objectives

The objectives of this study were:

1) to determine the distribution and abundance of moulting Canada geese in the vicinity of Bathurst Inlet and along the Hood, James, Burnside, Western, Huikitak, Ellice, and Back rivers.

2) to evaluate the importance of Key Habitat Sites in the study area.

3) to determine the subspecific composition of the moulting flocks.

4) to record ancillary information on other wildlife in the study area.

2.0 STUDY AREA

The study area includes portions of the northeast District of Mackenzie and the northwest District of Keewatin, Northwest Territories. The nearest communities are Cambridge Bay, Gjoa Haven, Baker Lake, Coppermine, and Bathurst Inlet (Fig. 1).

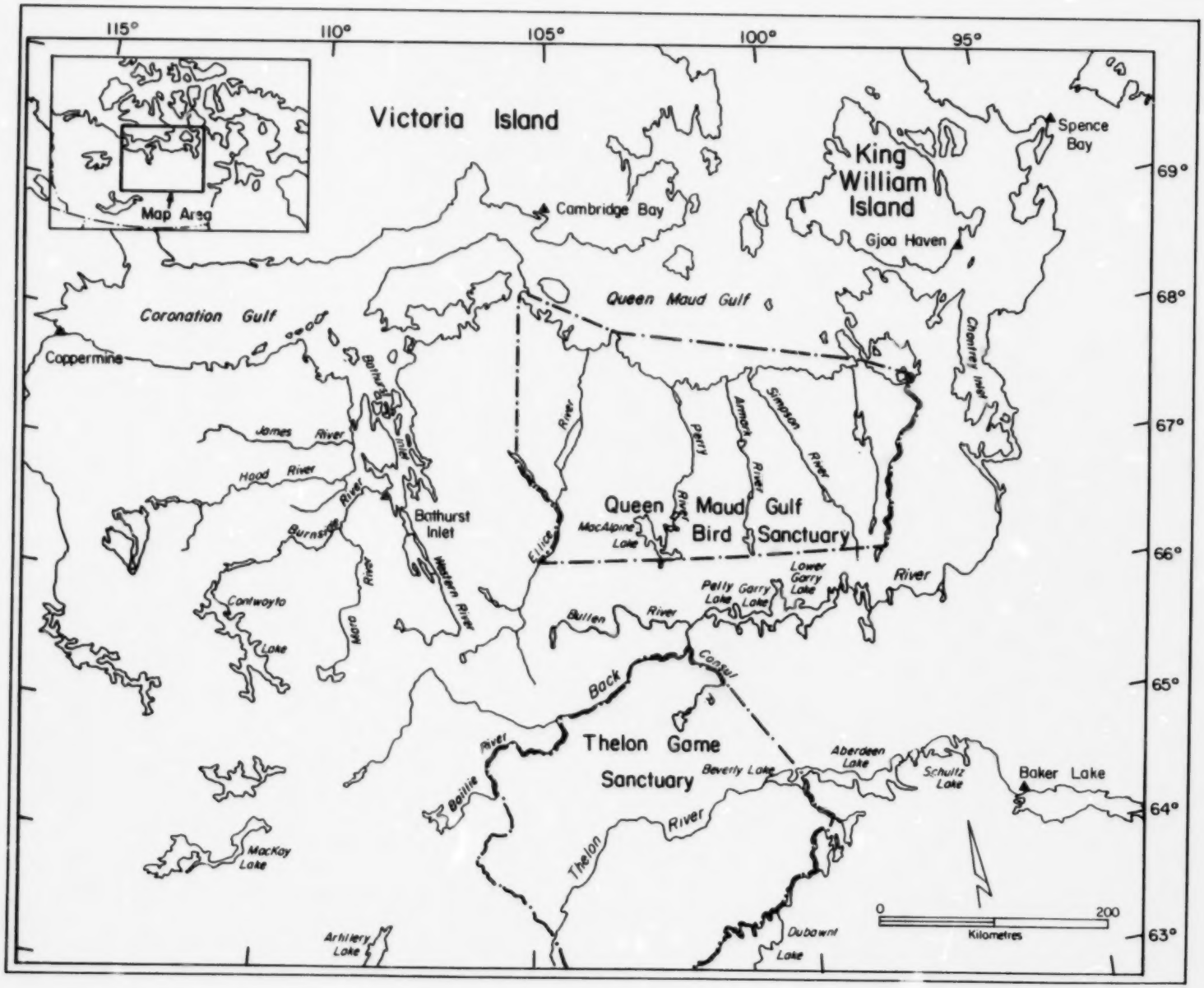

Figure 1. Location of the study area within the Northwest Territories.

Most of the Ellice River occurs within the Queen Maud Gulf Bird Sanctuary whereas parts of the Baillie and Back rivers represent the western and northern boundaries, respectively, of the Thelon Game Sanctuary.

2.1 Physiography

The study area is situated within the Kazan Physiographic Region which is characterized by massive rocks occurring in broad uplands, plateaus, and lowlands (Bostock 1970). Three divisions - the Bear-Slave Upland, the Bathurst Hills, and the Back Lowland are represented.

The Bear-Slave Upland, which occurs south and west of Bathurst Inlet, includes the James and Hood rivers and the headwaters of the Back River to approximately 106° W. Bare, massive bedrock is common on ridges whereas stoney till occurs in most valleys. Numerous small lakes, connected by short rivers, drain into the well-incised valleys of the major rivers (Zoltai et al. 1980).

The Bathurst Hills include the lower reaches of the James, Hood, and Western rivers; all of the Burnside River; and the area immediately surrounding Bathurst Inlet. Bare bedrock is common on ridges whereas marine sediments occur in low-lying areas near the sea. Locally, glacial till covers large areas (Zoltai et al. 1980).

The Back Lowland includes the remainder of the study area from Bathurst Inlet eastward to Chantrey Inlet. The area is characterized by generally low, gently undulating terrain punctuated by exposed bedrock. Countless small, rock-bound lakes connected by short, poorly defined creeks occupy the depressions (Zoltai et al. 1980)

2.2 Surficial Geology

Precambrian bedrock, of various ages, underlies the entire study area. The surface of this bedrock had been modified, on both a large and small scale, by the movement of glacial ice and the

subsequent effect of the meltwater. Although the same geological processes have occurred throughout the study area, the degree of surficial development has been influenced by the nature and relief of the bedrock.

The Bear-Slave Upland and Bathurst Hills are rugged; significant changes in elevation are common and often abrupt. Dissection is particularly intense along the Burnside and Western rivers where relief may exceed 305 m (Tremblay 1968). As a result, much bedrock is exposed and till occurs only in the valleys and on lower slopes. Till may be 10-20 metres thick in some portions of the major river valleys. Outwash deposits are common in the valleys of the Burnside, Hood, Western, and Hiukitak rivers.

The Back Lowland is covered by a substantial layer of till which may vary from less than one metre to several tens of metres thick (Thomas 1977). Landforms on irregular till surfaces commonly include undulating plains with abundant lakes, morainal features, and drumlins. Sand and gravel, with a significant boulder component are found in eskers, kames, and kame terraces. Glaciofluvial deposits include terraces, eskers, and outwash plains. Glaciolacustrine deposits consist of poorly-sorted, sandy tills and ice-contact materials which have been reworked by water from ice-dammed lakes.

2.3 Glacial Lake and Marine Submergence

Land in the Bathurst Inlet area has emerged 214-218 m since glaciation (Bird and Bird 1961). The most common marine deposits are silt and clays which occur in broad lowlands, particularly along the western side of Bathurst Inlet. The main body of marine clays occurs below the 40 m asl contour but small pockets occur in protected basins at elevations up to 150 m asl (Zoltai et al. 1980). Deltaic deposits occur at the mouth of the Burnside, Hood, and Western rivers.

There is some evidence that a glacial lake was formed or that the sea extended into the Back River valley. A delta with a wave-cut scarp, indicating the former presence of standing water, occurs on the Back River south of Beechy Lake. Well-formed beaches are present near 65°45'N, 101°00'W but their elevations are not known (Craig 1964). Fyles (pers. comm. in Craig 1964) noted patches of silt and poorly defined beaches up to about 550 feet (168 m) asl south of Macdougall Lake. Craig (1961) also noted a delta at 500 feet (153 m) asl near the mouth of Herman River.

2.4 Vegetation

The study area lies within the Low Arctic ecosystem (Polunin 1951). As the vegetation of this area has not been intensively studied, certain inferences must be drawn from studies which have been conducted in the lower Back River area (Edlund 1982) and in the vicinity of Bathurst Inlet (Zoltai et al. 1980). Similar plant communities grow throughout the area, however their extent and development are influenced by two factors - the prevailing surficial material and the soil moisture regime (Edlund 1982).

According to Edlund (1982), various surficial materials support characteristic vegetation:

Bedrock outcrops are vegetated, almost exclusively, by lichen and moss communities.

Well-drained tills and other glacial deposits with a significant boulder component, support lichen-heath tundra whereas dry sands, such as esker crests and fluvial terrace edges are covered by lichen-graminoid tundra.

Sands support dwarf shrub-monocot barrens and tundra communities whereas moderately drained silts are covered by cottongrass tussock tundra.

Poorly-drained silt and sand are dominated by wet sedge communities.

Fluvial and eolian deposits are dominated by monocots and forbs which are the major component of early stages of succession.

3.0 METHODS

The survey was flown, from 23-28 July 1984, in a Bell 206-B helicopter at approximately 30 m agl and about 160 kph. Speed was reduced and occasional stops were made to collect specimens, facilitate observations, and verify our data. Two observers, in addition to the pilot, were present. One individual occupied the left front seat while the other observer was positioned in the right rear seat. The pilot navigated along a pre-determined route (Appendix 1) which had been delineated on 1:250,000 topographic maps. The transect was positioned to maximize the area surveyed (maximum of 300 m) on either side of the land/water interface. The survey route was segmented into 10-km units to facilitate the recording of data.

The size and identity of all flocks within the transect were noted. Notes on the types of habitat (Appendix 2) and adjacent shorelines (Appendix 3) were also collected. All observations were recorded on a tape recorder and later transcribed onto appropriate data sheets.

A number of geese were collected to determine the subspecific composition of the moulting flocks. Body measurements (Appendix 4) were taken and study skins were prepared. Subspecific identity was determined from a comparison of the observed and published morphometric measurements (Appendix 6)(Hanson 1965, MacInnes 1966, Grieb 1970). Although Palmer (1976) has grouped the maxima and moffitti subspecies, our separation was attempted on the basis of the longer neck, longer body length, extensive cheek patches,

lighter pale pearly breast in males, white spotting on head or neck, greyer upper wing coverts, shape of bill, nail and bill serration, prominent scutellation on tarsi, white neck ring and general larger size in maxima (Hanson 1965). As there is overlap in hard body measurements between age and sex categories of the two subspecies (Hanson 1965) absolute separation remains difficult.

Observations on other wildlife (Appendix 5) were collected as time permitted.

4.0 RESULTS

4.1 Canada Geese

4.1.1 Distribution and Abundance

Moulting Canada geese occurred along much of the survey route which lies east of Bathurst Inlet (Fig. 2). Birds were encountered continuously from near Beechy Lake (105°30'W) to the east end of Garry Lake. The lower reaches of the Baillie, Jervois (65°25'N, 103°16'W), Consul, and Bullen rivers were also occupied. Isolated flocks occurred between the east end of Garry Lake and 96°30'W. Significant numbers were again encountered from 96°30'W eastward along the lower Back River. The Ellice River was continuously occupied northward from approximately 66°N whereas scattered flocks were noted in Portage Bay (67°05'N, 108°28'W) and at the mouth of Western River. Birds were also observed in inland areas, particularly between the Back and Ellice rivers and between the Ellice and Anjimajuq (68°11'N, 106°20'W) rivers.

No Canada Geese were seen along the Hood, James, or Burnside rivers.

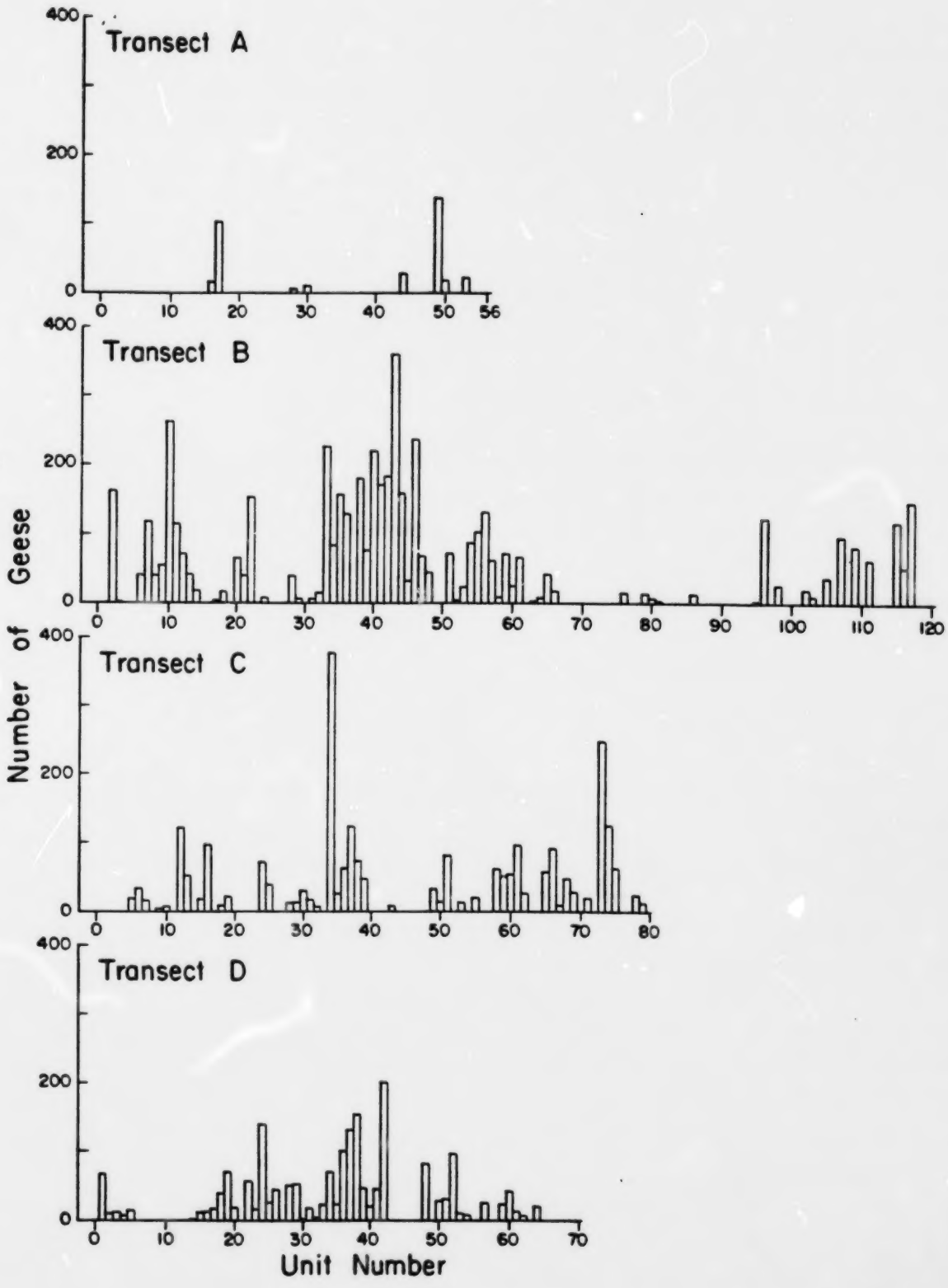

Figure 2. Distribution of Canada geese along the survey route, July 1984.

A total of 9,697 Canada geese were recorded during the survey (Appendix 5). The approximate distribution was: Back River system - 7893, Ellice River - 1162, Hiukitak River (67°08'N, 107°15'W) - 144, Bathurst Inlet - 136, and inland areas - 362.

4.1.2 Taxonomy

Thirteen moulting geese were collected. The collection site and identity of these birds are summarized in Table 1. Specimen measurements appear in Appendix 6.

4.1.3 Breeding Distribution

Twenty-five broods were observed within the study area (Table 2). Ten broods occurred on the lower 60 km of the Ellice River whereas another ten broods were scattered along the Back River system. Two broods occurred on the plain east of the Anjimajuq River and one brood was observed on the Hiukitak River.

4.2 Lesser Snow Geese

4.2.1 Distribution and Abundance

Nine hundred and three adult lesser snow geese were recorded during the survey (Appendix 5). Principal areas of concentration included: lower Ellice River - 54, Bullen-Back River junction to the east end of Upper Garry Lake - 467, and lower Back River - 403. The adults were accompanied by young in all of these areas.

The remaining 21 birds were scattered in small flocks along the Back River system or in Portage Bay (one flock). Young were not present in these areas.

Table 1. Collection site and subspecific identity* of moulting Canada geese (Branta canadensis), July 1984.

Specimen No.	Transect Unit No.[1]	Sex	Subspecies
1	A16[2]	M	moffitti
2	A16	F	moffitti
3	A16	M	maxima
4	A16	F	parvipes
5	A16	F	maxima
6	A16	F	moffitti
7	B06	M	maxima
8	B14	F	maxima
9	B33	M	maxima
10	B79	M	maxima
11	D27	M	maxima
12	D52	?	maxima
13	D52	M	maxima

* - A. Dzubin, CWS, pers. comm.

1 - See Appendix 1 for location of transect units.

2 - Birds were collected from a single flock within each transect unit.

Table 2. Distribution of breeding Canada geese, July 1984.

Transect No.	Group Size		No. Broods
	No. Adults	No. Young	
A49	4	6	2*
B95	4	6	2
B96	2	6	1
B117	6	?	1
C6	3	3	1
C61	2	1	1
	4	4	1
	3	3	1
D34	45	4	1
D36	8	8	2
	2	4	1
	2	3	1
D37	1	5	1
	25	?	1
D38	4	5	2
D40	8	8	2
D41	6	4	1
D50	2	4	1
D52	7	2	1
D59	2	2	1
		Total	25

* - Brood size was assumed to be four when more than two adults were present (see MacInnes 1962).

? - An undetermined number of young were present.

4.3 Significant Ancillary Observations

4.3.1 Glaucous Gull

A glaucous gull colony was discovered on an oblong island ($67^{o}42'N$, $108^{o}58'W$) adjacent to Kater Point, at the northern extremity of Arctic Sound. The colony contained approximately 400-500 pairs. This is the first recorded observation of this colony.

4.3.2 Falcons

Falcons were encountered on four occasions during the survey. Location and details are as follows:

A33: A single peregrine flew from a cliff which was just downstream from a set of rapids.

B84: A single peregrine flew from a possible nest site on a cliff. Although whitewash was obvious, no young were observed.

C06: A single gyrfalcon was perched on a cliff face directly above the river. No whitewash was observed and the cliff was not inspected further.

D25: A pair of grey falcons flew off a cliff ledge in this transect unit. No young were noted, but whitewash below the ledge suggested that it was a nest site. The birds were not positively identified.

4.3.3 Moose

A lone cow moose was observed, in a patch of willows, at the mouth of an unnamed river ($67^{o}47'N$, $110^{o}47'W$) which flows into Gray's Bay. The willows were approximately 5-7 m high.

5.0 DISCUSSION

5.1 Canada Geese

5.1.1 Distribution

The Back River has been known as a major goose moulting area for over 100 years. Back (1836) reported that the bank willows, between the mouths of the Baillie and Jervois rivers, were the retreat of hundreds of moulting geese. Similarily, the area between Mount Meadowbank (66°10'N, 96°58'W) and the Montressor River (66°32'N, 95°49'W) harboured numerous flocks which "had left thousands of the finest quills strewed on the sand." Anderson (1856) first encountered moulting geese at Malley Rapids (65°04'N, 107°21'W) and noted geese on virtually every subsequent day as he progressed eastward. "Hundreds" of geese were seen between Baillie River and Hawk Rapids (65°33'N, 103°11'W) and just above the Montressor River. An "abundance" of geese was also noted near the outlet of Franklin Lake. In 1953, Breckenridge (1955) observed primary feathers on the shore of a bay near his camp (66°10'N, 96°57'W) but no birds were encountered between this site and the east end of Lower Macdougall Lake (66°00'N, 98°37'W). Tener (1956) noted that apparent moulting adults were distributed, in various-sized flocks, from Beechy Lake (65°20'N, 106°49'W) to Pelly Lake. Dzubin et al. (1980) identified the following areas of concentration: 1) Baillie River to Jervois River, 2) McKinley River (65°30'N, 102°23'W) to Pelly Lake, 3) southern bays of Pelly, Upper Garry, and Lower Garry lakes, and 4) Herman River (66°14"N, 96°07'W) to Franklin Lake.

Smith and Sutton (1953) and Barry (1960) have observed moulting Canada geese on the Ellice River. Moulting geese were also observed in 1977 by H.A. Hochbaum (Dzubin et al. 1980). None of these reports, however, discuss the specific location of concentrations of birds.

Moulting Canada geese have been observed at "Moult Lake" (66°57'N, 108°21'W) since 1974 (G. Warner, pers. comm.) although this is the first record of moulting geese in Portage Bay. In 1979, 19 birds were observed on an unnamed lake (67°23'N, 107°13'W) and another 12 geese were seen on the lower Hiukitak River. Extensive goose droppings were also observed at the mouth of the Western River, although no birds were present (S. Zoltai, CFS, pers. comm.).

Despite a number of field studies (McEwen 1957, Kelsall 1966, Zoltai et al. 1980), no geese have been recorded on the Hood, James, or Burnside rivers. Similarily, no birds were recorded during this survey. Limited areas of apparently suitable habitat (see 5.1.4) were present in some locations but there was no evidence of moulting geese. These areas are probably outside the traditional migration routes of moulting Canada geese.

Available evidence indicates that Canada geese occupy traditional moulting grounds although there is year-to-year variation in the numbers present at each site. Back's (1836) and Anderson's (1856) subjective impressions suggest that more birds occurred on the Lower Back River than along its upper reaches. Their impressions are contrary to our observations. It is obvious, however, that moulting birds move considerable distances along the rivers (Breckenridge 1955), possibly to exploit additional feeding areas. The availability of these sites (and the distribution of geese) would be dependent on the phenology of spring break-up (see 5.1.6).

The occupation of certain isolated moulting sites raises some intriguing questions. Sites such as Portage Bay, "Moult Lake", and the mouth of the Western River have limited sedge meadows which can support a finite number of geese. The sedge meadow at Portage Bay was extensively cropped - similar to a golf green. The number of moulting birds at "Moult Lake" has been remarkably constant (G. Warner, pers. comm.). The method of determining the number of individuals which remain at such sites merits further consideration.

5.1.2 Abundance

An estimate of abundance is complicated by two principal factors - the inherent biases in aerial surveys and the amount of available habitat which was not surveyed. Additional factors include: 1) the predisposition of moulting geese to "freeze" in response to anticipated danger (helicopter), 2) the dispersal of birds, which have regained flight, well ahead of the helicopter, and 3) no measure of observer accuracy in determining flock sizes. A number of flocks were photographed to verify observer estimates but the poor quality of the slides prevented an accurate determination of numbers.

Aerial surveys underestimate animal density (Stott and Olson 1972, Caughley 1974, Haddock and Evans 1974, Savard 1982). There are no published visibility correction factors available for flocked, moulting geese (A. Dzubin, CWS, pers. comm.). Haddock and Evans (1974) recommend a conversion factor of two for helicopter surveys of dispersed, breeding Canada geese whereas a factor of 2.02 (mean of 15 simultaneous aerial and ground surveys) was derived for fixed-wing aircraft surveys of wintering waterfowl (Stott and Olson 1972). The clumped distribution of these species would approximate the distribution of flocks of moulting geese. Accordingly, a conversion factor of two has been used when estimating total moulting goose abundance along the survey route, including nearby unsurveyed shorelines. With regard to unsurveyed areas, the mean number of moulting birds per transect unit in adjacent surveyed habitats was determined and applied to the unsurveyed areas.

The following abundance estimates must be interpreted in light of the above considerations.

5.1.2.1 Back River System

Two hundred and forty-six km of shoreline, in the Pelly-Lower Garry Lake area was not surveyed (Appendix 1). The mean density of moulting geese in this area (units 38-66 inclusive) was 84.3 birds per transect unit. Therefore, an estimated 2073 birds

were present in the unsurveyed area. A further 203 km of shoreline in the Bulliard-Lower Macdougall Lake area was not surveyed. The mean density of birds in this area (units 67-80 inclusive) was 2.4 birds per transect unit. An estimated 48 birds were present in this unsurveyed area.

The estimated total population on the Back River system is 7893 (observed birds) + 2121 (estimated number from unsurveyed areas) = 10,014 x 2 (visibility correction factor) = 20,028 birds. "Based on the number of observed geese, extent of suitable habitat, areas of previous glacial submergence, along with observations of other investigators", Sterling and Dzubin (1967) estimated a total of approximately 8000 birds on the Back River system. Despite the obvious limitations to direct comparisons (survey techniques, survey aircraft, extent of survey, etc.), it appears that there has been a significant increase over the last fifteen years. This increase is expected in light of the increase in the relevant Canada goose populations over the same period (A. Dzubin, CWS, pers. comm.).

5.1.2.2 Ellice River

Thirteen km of shoreline at the mouth of the Ellice River was not surveyed. The average density in adjacent areas (units 38-40 inclusive) was 73 birds per unit. Therefore, an estimated 95 birds were present in this area. Also, units 43-45 were not surveyed due to navigational problems. The average density of birds on the opposite side of the river (units 36-38 inclusive) was 127.6 birds per unit. Therefore, an estimated 383 birds were present along this portion of the river. Much of the west side of the river (opposite units 14-34 inclusive) was not surveyed. Assuming that the east and west shorelines supported similar densities, 669 birds were present on the west side.

The estimated total population on the Ellice River is 1162 (observed birds) + 1147 (estimated number from unsurveyed areas) = 2209 x 2 (visibility correction factor) = 4,618 birds. Smith and Sutton (1953) recorded 2526 geese during July 1953 whereas Barry (1960) estimated that 4,114 birds were present during

14-20 August, 1960. Geese apparently leave their moulting grounds immediately after attaining flight (Sterling and Dzubin 1967). In view of the late survey date, it is possible that Barry observed some birds which had moved to the river from adjacent moulting areas. The plain, west of the Ellice River, supports numerous moulting birds (G. Warner, pers. comm.; pers. obs.). Despite limited evidence, it appears that numbers on the Ellice River have not increased like those on the Back River. Additional surveys are required to confirm this observation.

Lack of historical data precludes a discussion of the remaining moulting sites.

5.1.3 Key Habitat Sites

"Key Habitat Sites" (see section 1.1) within the study area include: Queen Maud Gulf, Middle Back River, and Lower Back River (McCormick *et al*. 1984).

5.1.3.1 Ellice River

Clearly, the Ellice River deserves recognition as a Key Habitat Site. The estimated 4,618 birds which occur along this river are a significant component of the large Canada Goose (*maxima*-*moffitti*) population. Although presently included within the Queen Maud Gulf Key Habitat Site, it deserves increased recognition with regard to Canada geese.

5.1.3.2 Middle Back River

This site comprises the Back River system from a point 10 km west of the McKinley River downstream, including Pelly Lake, Upper Garry Lake, Garry Lake, and Lower Garry Lake to 99° W (McCormick *et al*. 1984). Surveys in the 1960's indicated that the site supported approximately 3000 moulting Canada geese (Sterling and Dzubin 1967).

Four thousand eight hundred and ninety-five geese were recorded during this survey (Appendix 5). Therefore, the estimated total population for this site is 4895 (observed birds) + 2121 (estimated number from unsurveyed areas) = 7016 x 2 (visibility correction factor) = 14,032 birds. This number represents approximately 70% of the estimated total population on the Back River system.

Another 1526 birds were observed between the junction of the Baillie and Back rivers and the west end of this site. In view of the numbers observed in this area, the Key Habitat Site should be extended to the mouth of the Baillie River. Further surveys will confirm this interpretation.

5.1.3.3 Lower Back River

This site includes the lower Back River from the mouth of Herman River downstream along Franklin Lake to the mouth of Hayes River and north to Cockburn Bay (McCormick et al. 1984). Over 900 moulting Canada geese were recorded between Herman River and Chantrey Inlet in mid-July, 1976 and about 620 birds were observed in the same area on 9 July, 1977 (Allen and Hogg 1979).

Five hundred and ninety-two geese were recorded during this survey which covered approximately half of the shoreline within this site. Therefore, the estimated population within this site is 592 (observed birds) x 2 (unsurveyed shoreline) = 1184 x 2 (visibility correction factor) = 2,368 Canada geese. This estimate must be considered in light of the assumptions mentioned above. A more extensive survey, planned for 1986, will define the population in this site.

5.1.4 Preferred Habitats

MacInnes (1962) observed that the feeding ground of Canada geese "characteristically included mats of low sedge resembling a wet golf green and were well supplied with open water".

Similarly, Sterling and Dzubin (1967) noted that moulting geese were always associated with sand beaches and sedge meadows which are flooded in spring.

A visual assessment of the dominant type of shoreline (Appendix 3) and adjacent habitat (Appendix 2) was made for each transect unit. Despite its obvious limitations, such an evaluation provides a first-order approximation of habitat selection by moulting geese. However, interpretation of this association is complicated by the mobility of moulting geese. Sterling and Dzubin (1967) reported that geese banded at a site on the Thelon River were recaptured four days later at another location, 30 miles distant. Observations by Breckenridge (1955) suggest that moulting geese will move considerable distances, possibly to exploit additional feeding areas.

Moulting geese were concentrated in areas of extensive sedge meadow. This was particularly evident along the lower reaches of the Jervois, Consul, and Bullen rivers, and in the Pelly Lake area. The association with sedge meadows is also obvious in the Bathurst Inlet area. Moulting geese were encountered at Portage Bay, "Moult Lake", and Western River, near sites of limited, but well defined sedge meadows. The Portage Bay site was extensively covered with goose droppings. In 1979, the sedge area at the mouth of the Western River was also extensively covered with goose droppings, although no birds were present (S. Zoltai, CFS, pers. comm.). Moulting flocks along the lower Back River were also closely associated with sedge which was often of limited extent.

Moulting geese were less selective in their choice of shoreline. Although broad sand bars occurred in association with extensive sedge meadows, other shoreline types predominated in areas of limited sedge. Gravel shorelines were common in the Bathurst Inlet area and in the Lower Garry Lake-Lower Macdougall Lake area. Bouldery shorelines were also common in the latter area and along portions of the lower Back River. Bedrock outcrops

occurred along much of the remainder of the lower Back River. Nevertheless, moulting geese were usually encountered in areas where isolated patches of sedge existed.

It appears that suitable forage is the primary factor in the distribution of moulting geese.

5.1.5 Taxonomy

The origins of geese which moult within the study area are poorly known. Dzubin et al. (1980) indicated that birds on the upper Back and Baillie rivers were referrable to maxima and moffitti subspecies of the Central and Pacific Flyways. Although various subspecies and populations may mix during the summer, there is a tendency for eastern populations to moult in eastern longitudes and western ones to moult further west (A. Dzubin, CWS, pers. comm.). One bird recovered near the mouth of the Ellice River had been banded in central British Columbia (Dzubin et al. 1980). Cowan (1954) reported the recovery of two birds near Bathurst Inlet which had also been banded in British Columbia. Birds on the Ellice and Atkinson Point rivers have also been attributed to these large subspecies (Kuyt et al. 1972).

Our collection of specimens is consistent with the above observations. All but one of the specimens were referrable to maxima or moffitti (A. Dzubin, CWS, pers. comm.). Only maxima specimens were collected east of Bathurst Inlet, however, this may not be significant in light of the small sample size. The lone parvipes specimen, which was collected at Portage Bay, may have been a failed local breeder.

One additional observation is noteworthy. A Canada Goose wearing a red neck collar, was observed on the southern arm of Lower Garry Lake (unit B46). Although markings on the collar could not be recorded the red collar indicated that the bird was banded within the Pacific Flyway (S. Wendt, CWS, pers. comm.).

5.1.6 Breeding Distribution

A total of 25 broods were observed during the study. Approximately half (12) of the broods occurred on the Ellice River, north of 67°30'N. Three broods were noted at the Bullen-Back rivers junction and three more broods were observed on the Back River between Montressor River and Franklin Lake. The remaining broods were encountered at various locations (Table 2). Approximately half the broods had banded together with other broods or flocks of moulting birds.

Available evidence (Palmer 1976) suggests that the Back River birds are B. c. parvipes and the Ellice River birds are B. c. hutchinsii. However, due to considerable intermixing these birds are referred to as a parvipes-hutchinsii complex. The subspecific characterization of these intermediate forms has not been adequately examined (A. Dzubin, CWS, pers. comm.). Branta c. hutchinsii breed in coastal areas of the mid-Arctic islands and the mainland from Yukon to Hudson Bay and Foxe Basin. This may explain the relative concentration of broods on the lower Ellice River. It also appears that more breeding habitat is available in this area (see below) than along the Back River system. The subspecific status of breeding birds on both river systems should be confirmed.

The scarcity of breeding birds along the Back River system was unexpected. Preferred nest sites of B. c. parvipes-hutchinsii are small, hummocky, sphagnum-covered islands surrounded by water (MacInnes 1962). There appeared to be ample breeding habitat in certain areas, particularly along the Jervois, Bullen, and Consul rivers. Canada geese begin nesting during the first week of June at McConnell River (60°50'N, 94°25'W). Most of the dry portions of this breeding area are less than two feet above summer water level, however spring thaw is very rapid and a stable summer water level is quickly reached (MacInnes 1962).

Average peak discharge of rivers within the study area are: Ellice River - 29 June (N = 5), Baillie River - 13 June (N = 4), and Back River - 29 June (N = 10) (D. Curtis, IWD, pers. comm.). There is also a significant rise in water levels associated with spring break-up (Table 3). It appears that suitable habitat is flooded during much of the breeding period. Therefore, breeding geese are restricted to habitats which are above the high-water mark of these rivers. Observed broods had probably moved to the rivers after hatch.

5.2 Lesser Snow Geese

5.2.1 Distribution and Abundance

5.2.1.1 Ellice River

Two colonies, at 65°55'N, 104°15'W and 67°20'N, 104°00'W, support both Ross' and lesser snow geese (Kerbes et al. 1983). Lesser snow geese and young were present on the Ellice River from 67°23'N to the northern limits of the survey (Appendix 5). The approximate southern limit of their distribution was the junction of the Ellice and an unnamed river which flows from the site of the northern colony. It is possible that geese entered the Ellice River via this river. No Ross' geese were observed but they may have been undetected in the larger flocks.

There are no previous quantitative records of snow geese on the Ellice River.

5.2.1.2 Middle Back River

The largest number of lesser snow geese occurred between the Bullen-Back River junction and the east end of Upper Garry Lake. Four hundred and sixty seven adults and 51 young were recorded. Many more young, intermingled with large flocks of adults, were present. This is the first record of breeding lesser snow geese at this location (A. Dzubin, CWS, pers. comm.) which is at least 80 km from the nearest known colony (66°45'N, 125°53'W) in the Queen Maud Gulf Bird Sanctuary (Kerbes et al. 1983).

Table 3. Water levels on the Ellice, Baillie, and Back rivers, 1983[1].

	Ellice River (67 42'N, 104 08'W)	Baillie River (65 02'N, 104 31'W)	Back River (66 05'N, 96 30'W)
Min. Annual Level (m)	2.946 (2 Dec.)	4.168 (11 Dec.)	0.925 (15 May)
Max. Annual Level (m)	4.886 (5 July)	11.959 (13 June)	8.288 (20 June)
Level (m) - 25 July[2]	4.195	5.416	4.458

1 - most recent available data.

2 - mean date of 1984 moulting goose survey.

Small colonies of lesser snow geese have been recorded previously in interior Keewatin. Clarke (1940) encountered "a flock of adults and young on August 7, 1937" on Beverly Lake, whereas Sterling (unpubl. report in Dzubin et al. 1980) recorded seven nesting sites on islands in the Thelon River, three or four miles west of the west end of Aberdeen Lake. Fifty-five nests were located in 1963 and 97 nests were recorded in 1964. In 1966, Kuyt observed a colony of 30-40 pairs near the west end of Aberdeen Lake. Also, in July 1970, Miller (1972) documented 21 nests at Kazan Falls (63°43'N, 95°51'W). All of these colonies are located over 200 km inland from marine habitats but are in areas previously inundated by post-glacial lakes. The Pelly Lake area has a similar post-glacial history.

Numerous small islands are dotted throughout Pelly and Upper Garry lakes. Superficially, they resemble the nesting islands of colonies in the Queen Maud Gulf Bird Sanctuary. On the basis of habitat features, there appears to be considerable potential for expansion of this colony. Additional surveys, to determine the breeding distribution of this colony and to monitor its population status, are required.

5.2.1.3 Lower Back River

Lesser snow geese were encountered along the lower Back River from the outlet of Franklin Lake to Mistake River (66°55'N, 95°17'W). A total of 403 adults and 64 young were counted. Additional young were present, in the larger flocks, but could not be enumerated.

Lesser snow geese and their broods have been observed previously in this area. MacLaren and MacLaren (1982) noted recently-fledged young among 717 adults recorded in late August, 1975. Three broods were also recorded among 4753 moulting geese which were observed in early July, 1976. Approximately 560 adults were recorded along Franklin Lake in early August, 1976 (Zdan and Brackett 1977). Little nesting occurred in northern

Keewatin during 1976 (MacLaren and MacLaren 1982). Also, approximately 60 birds were observed along Mistake Lake and River in July, 1977 (Allen and Hogg 1978).

This area appears to support both moulting adults and a small breeding colony. Further surveys are required to locate the breeding colony and to monitor the status of both breeding and moulting populations.

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7.0 APPENDICES

Appendix 1. Route of moulting goose survey, July 1984.

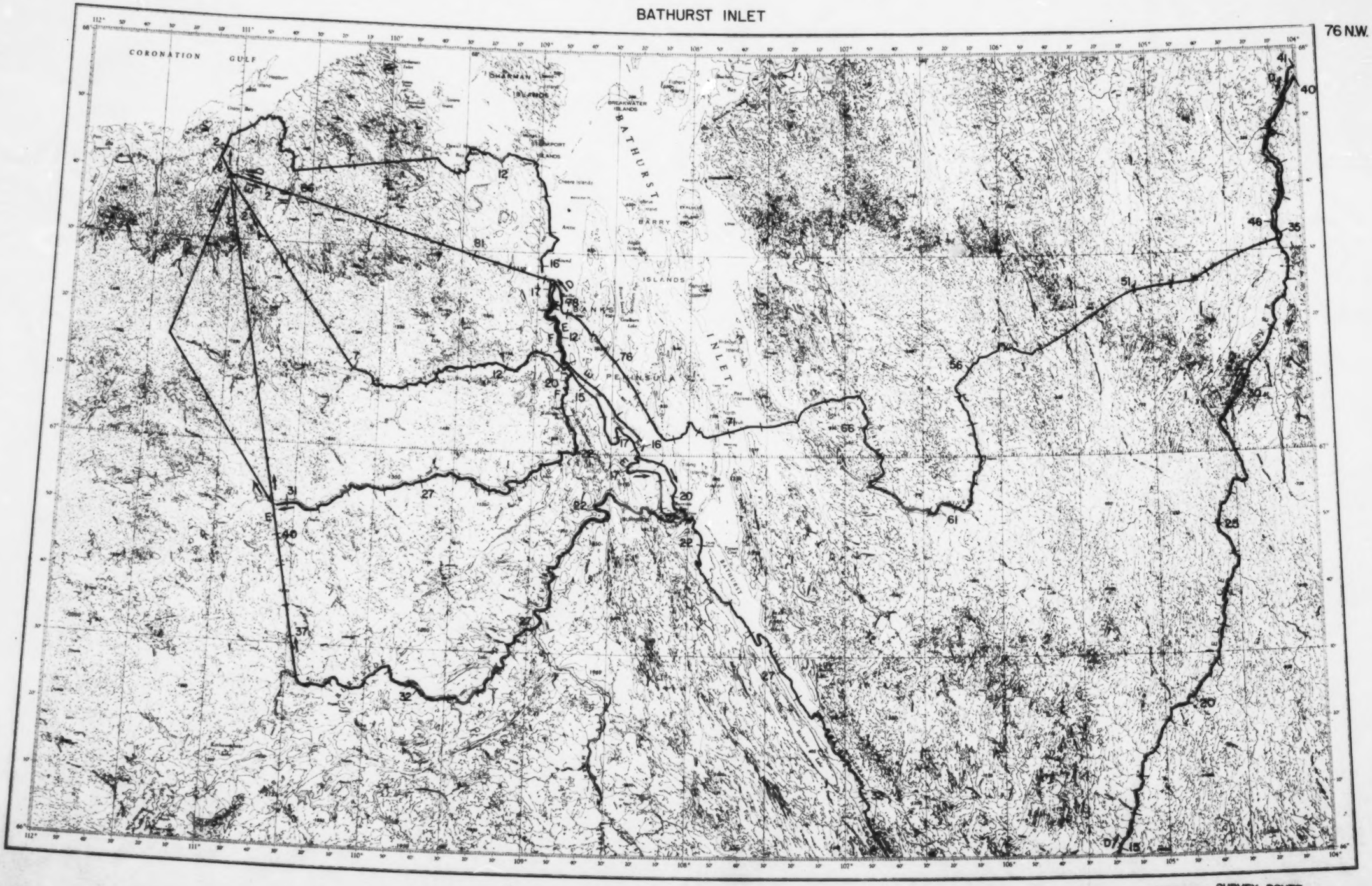
Sectors of the survey route were flown on the following dates:
A-23, B-24, C-25, D-26, E-27, F-28.

▲- base camp

■- fuel cache

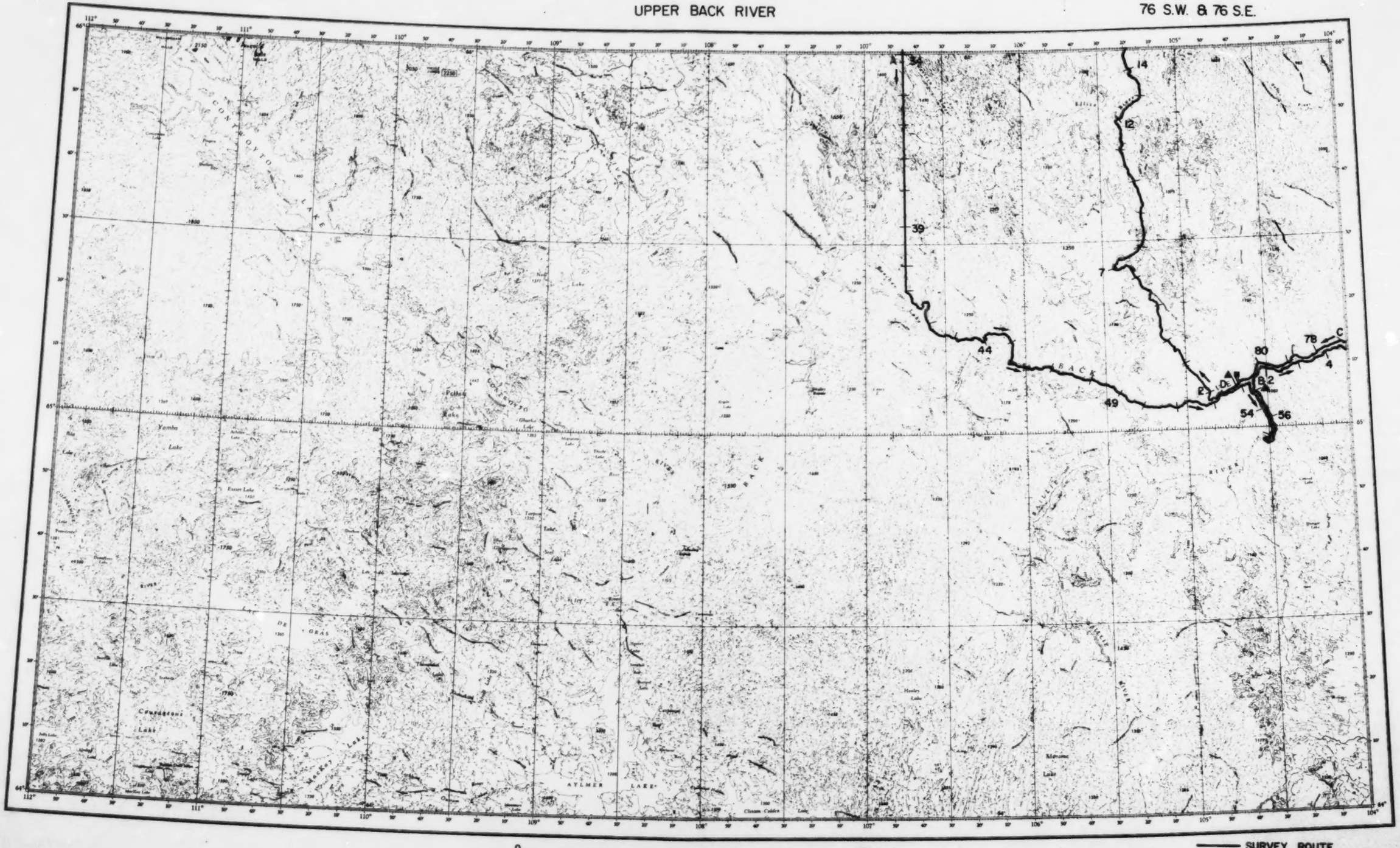
BATHURST INLET

76 N.W. & 76 N.E.



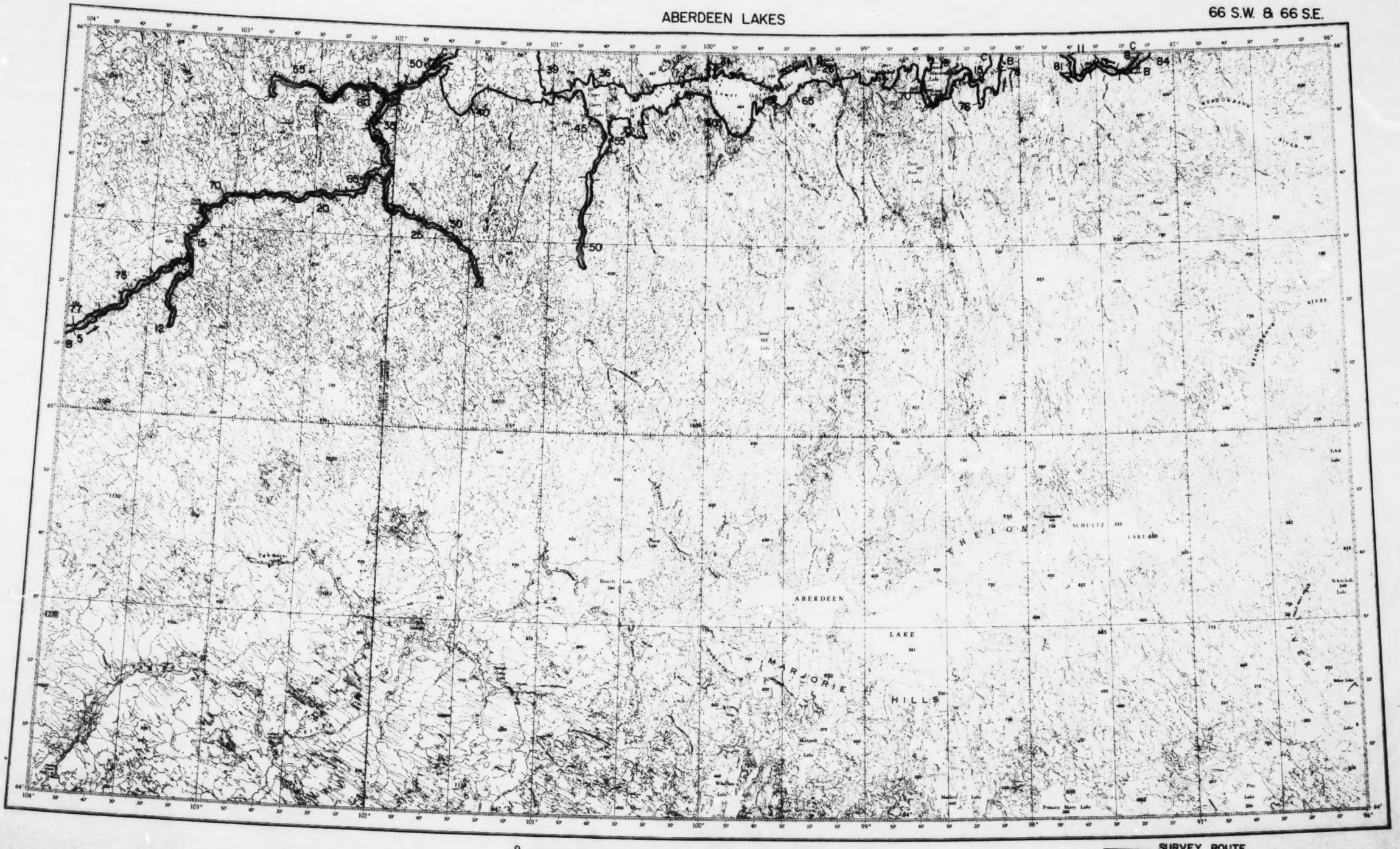
UPPER BACK RIVER

76 S.W. & 76 S.E.



ABERDEEN LAKES

66 S.W. & 66 S.E.



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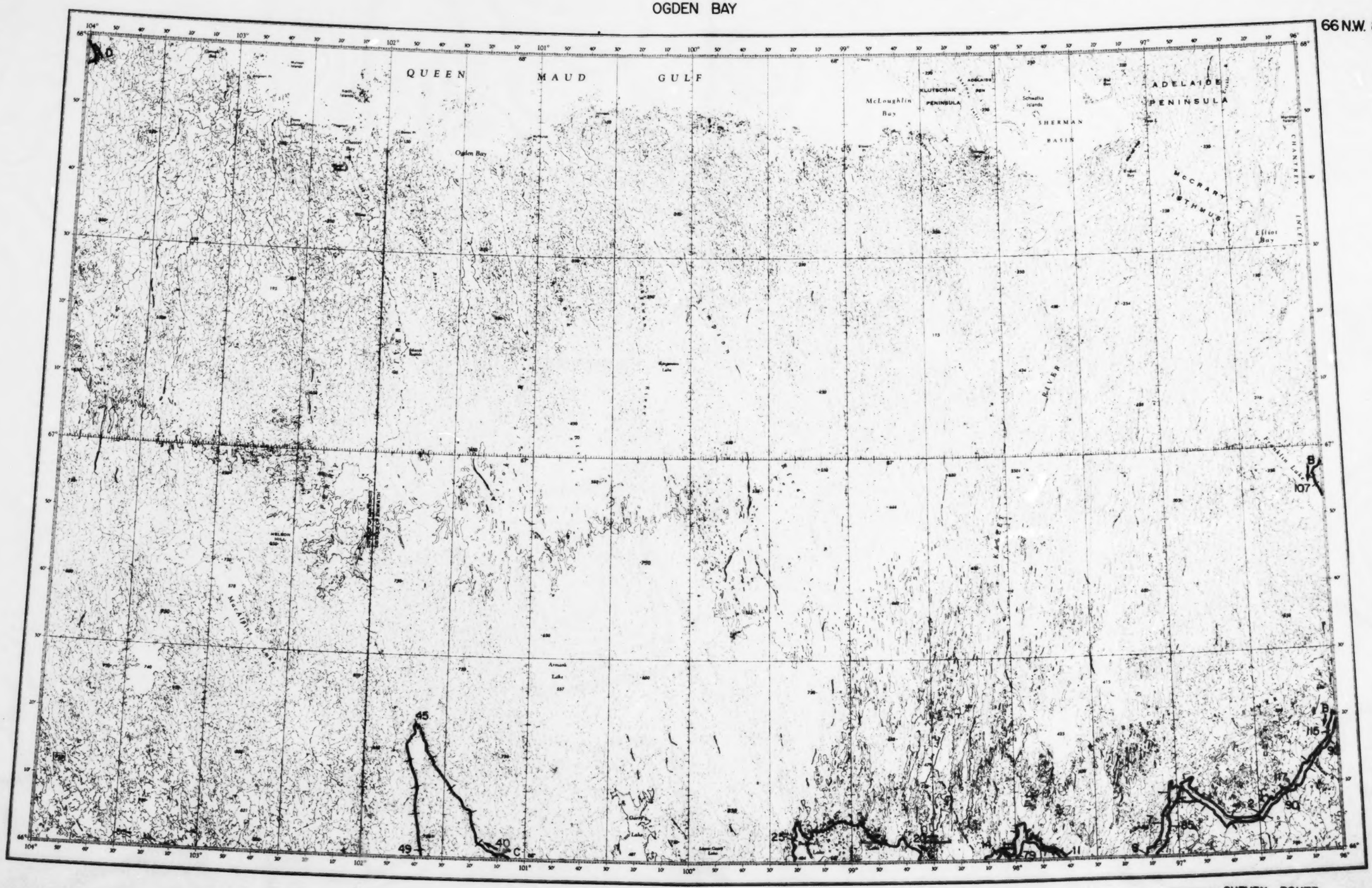
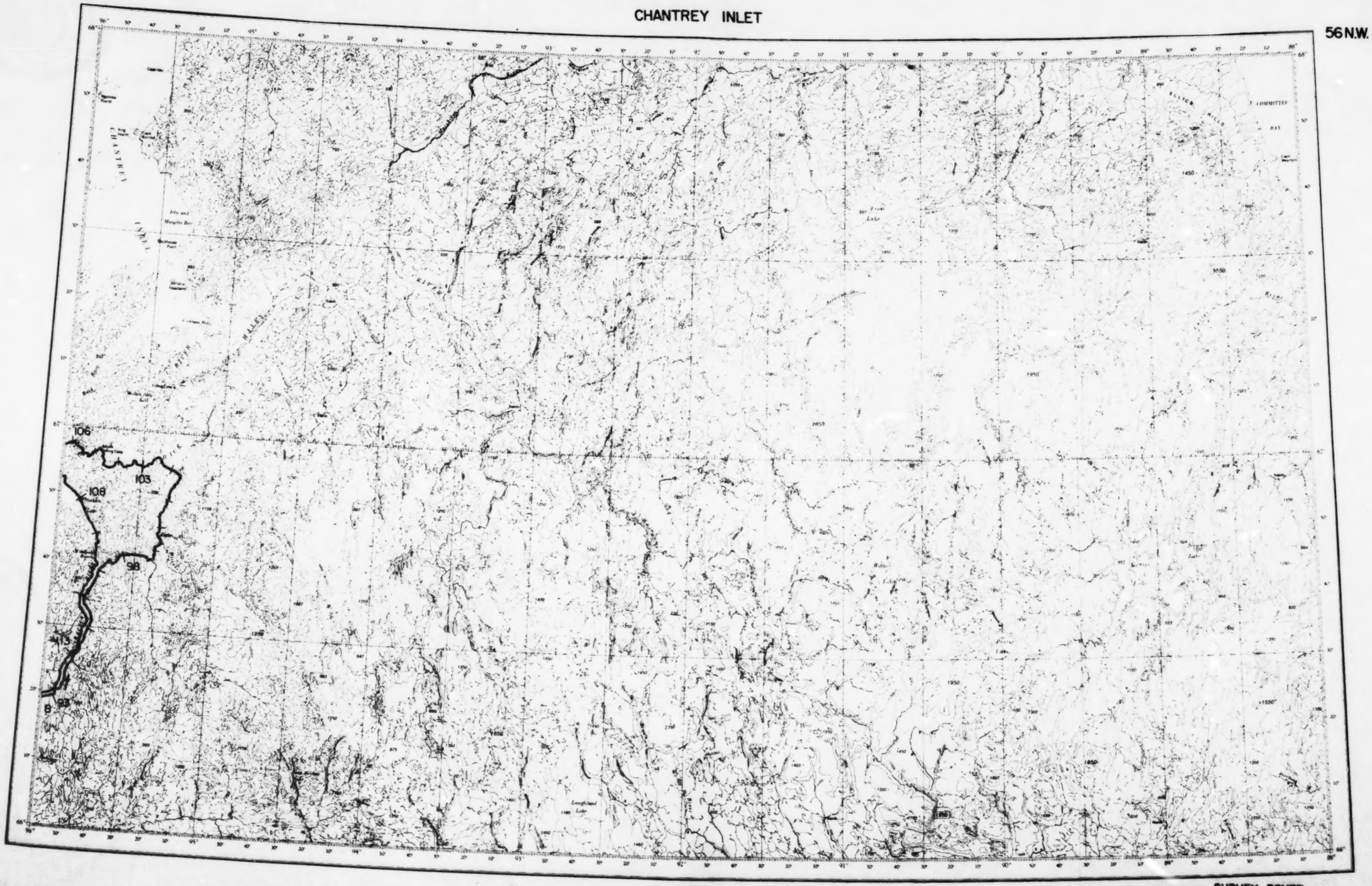
OGDEN BAY

66 N.W. & 66 N.E.



CHANTREY INLET

56 N.W. & 56 N.E.



Appendix 2. Definition and description of habitats*.

Sedge Meadow:	occurs in lowlands, moist valley bottoms and in bedrock depressions where water availability is generally the greatest. Several species of sedge (Carex spp.) and cottongrass (Eriophorum spp.) are abundant as well as several rushes (Juncus spp.) and horsetail (Equisetum variegatum). Cottongrass tussocks (Eriophorum vaginatum) frequently dominate the visual aspect.
Willow-Sedge Meadow:	occurs on slighty drier but imperfectly drained areas such as the edge of ponds and marshes, along upland drainageways and meltwater channels and along the edge of depressions. They are frequently situated on low to mid-slopes adjacent to sedge meadows. Sedges and cottongrass dominate the visual aspect although willows are also common.
Orthophyll Shrub:	occurs on moderate, well-drained, medium-textured, well-watered tills, characteristically on mid slope. Frost action, in the form of earth mounds and hummocks, is evident. The visual aspect is dominated by Betula glandulosa and Vaccinium uliginosum; Cassiope tetragona, Empetrum nigrum, and Salix spp. are prominent secondary shrubs.
Lichen-Heath Plateau:	occupies a position on the moisture gradient between Orthophyll Shrub and Lichen Upland. It occurs on the thin medium-to-coarse textured soils of crests and upper slopes. Fructicose lichens (Alectoria ochroleuca and Cornicularia divergens) co-dominate the aspect with Cassiope tetragona and Ledum decumbens.

Lichen Uplands: are characteristic of the driest sites found on rapidly drained areas of coarse materials. These areas are totally dominated by lichens which generally occur as a loose intertwined mat of the dominant species and includes numerous other species. Lichen Uplands show a marked reduction in shrubs relative to Lichen-Heath Plateau.

Barrens: occur only on rock, the most windswept exposed terrain and in areas of natural disturbance. Lichens are the most common ground cover.

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* From: Thompson 1980.

Appendix 3. Definition and description of river and lake shorelines*.

organic - referring to or derived from living organisms. Any compound containing carbon.

clay - a sediment with particles, regardless of mineral composition, having a diameter less than 1/256 mm.

sand - detrital material with a size ranging from 1/16 to 2 mm.

gravel - rounded waterworn pebbles and rock grains with a diameter ranging from 4.7 to 76 mm.

cobble - rounded waterworn pebbles and rock fragments ranging between 64 and 256 mm in diameter.

boulder - large rounded stones lying on the surface of the ground which are greater than 256 mm in diamater.

bedrock - solid rock exposed at the surface of the earth.

* From: Dictionary of geological terms. 1976. Anchor Press, New York. 472 pp.

Appendix 4. Description of goose body measurements*.

Culmen 1:	length of upper mandible from the point where the forehead or unfeathered integument of the forehead fuses into the horn portion of the mandible (Fig. 1), to the tip of the bill.
Culmen 2:	length of upper mandible from the maximum lateral extent of mandible, ie. where feathered skin meets the upper point, to tip of bill (Fig. 3).
Culmen Width:	width of culmen at midpoint of nares (Fig. 4).
Head Length:	length from protuberance at foramen magnum to tip of bill.
Head Width:	width of head at a point immediately in front of the eye.
Tarsus - Bone:	length from the most anterior medial condyle of the tarsus where it articulates with the mid-toe to the round lateral edge of the articular surface where the tarsus (tarsus-metatarsus) articulates with the exterior lateral condyle of the tibia (Fig. 7).
Tarsus - Total:	length from the most anterior medial condyle of the tarsus where it articulates with the mid-toe to the exterior portion of the skin covering and including the condyles of the tibia (when this bone is nearly at right angles to the tarsus (Fig. 7).
Mid - Toe:	with the mid-toe pressed upwards against a flat surface it is the distance from the edge of the outer articular surface of the middle toe with the tarsus to the distal end of the toe at the base of the claw (Fig. 7).
Mid - Tail:	length of either middle retrice from its insertion at the skin to the tip of the feather.

Flat Wing: length of the folded wing from the anterior edge of the wrist joint to the tip of the longest primary. (The wing is depressed with two fingers in the area of the primary coverts so that its ventral surface is completely flattened against the board).

Sixth Primary: length of the sixth primary from its insertion at the skin to the tip of the feather.

Total Length: bird is laid on its back on a ruler with head and neck clasped in one hand and the other hand on the bird's abdomen. Length of bird is from the tip of the bill nail to the tip of the longest tail feather. Bird is not stretched (Fig. 6).

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*From: A. Dzubin, CWS, pers. comm.

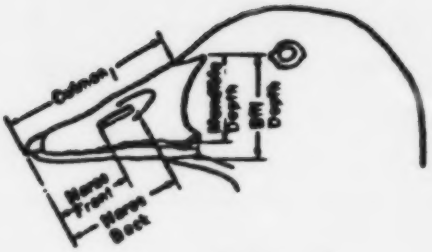

Figure I

Figure II

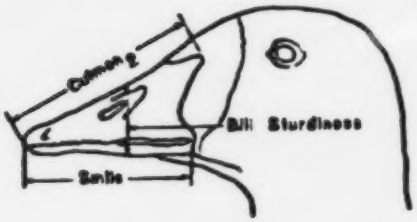

Figure III

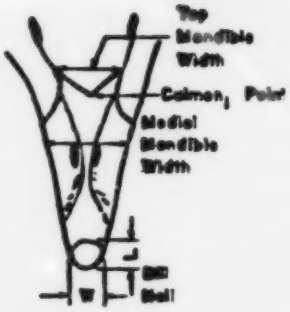

Figure IV

Figure V

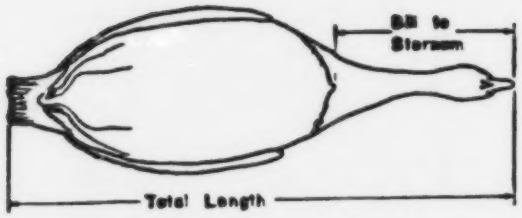

Figure VI

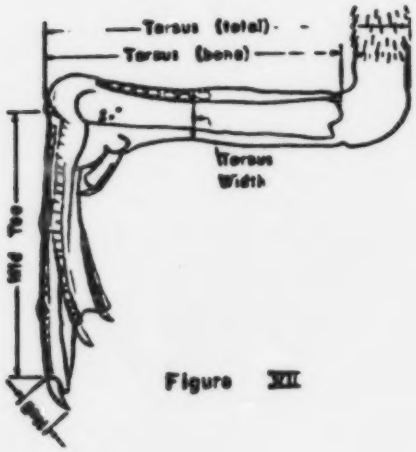

Figure VII

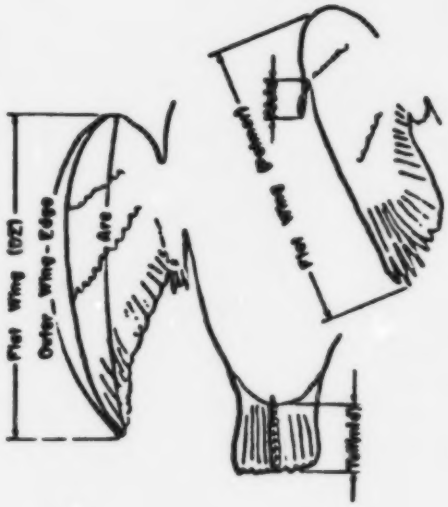

Figure VIII

Appendix 5. Summary of wildlife observations, July 1984.

The species observed during the survey are: red-throated loon (RTL), arctic loon (AL), tundra swan (TS), white-fronted goose (WFG), snow goose (SG), unidentified goose (UG), scaup (SC), oldsquaw (OLD), seaduck (SD), unidentified duck (UD), merganser (MER), rough-legged hawk (RLH), golden eagle (GE), falcon (FAL), peregrine falcon (P), gyrfalcon (G), glaucous gull (GG), wolf (WLF), caribou (CAR), muskoxen (MU), grizzly bear (GB), moose (M), and wolverine (WLV).

Appendix 5. Continued.

Date: 23/07/1984

Transect: A

Unit No.	Species															
	RTL	TS	CG'	WFG	SG	UG	SC	OLD	UD	MER	RLH	GE	FAL	WLF	CAR	MU
8										8						
11										6						
12										6						
14												1				
16			15		5											
17			104													
19				6												
22		2														
23		4+2								3						
24		1														
28			7													
30			10													
31										3		1				
33													1P			1
34																1m
37																3m

Appendix 5. Continued.

Date: 23/07/1984

Transect: A

Unit No.	Species															
	RTL	TS	CG	WFG	SG	UG	SC	OLD	UD	MER	RLH	GE	FAL	WLF	CAR	MU
42										1					20	
44			28							1						
46										9		1				
47									6					1		
48														1		
49			139+6													
50			18							1						
52											1					
53			22											1		

Appendix 5. Continued.

Date: 24/07/1984

Transect: B

Unit No.	Species															
	RTL	TS	CG	WPG	SG	UG	SC	OLD	UD	MER	RLH	GE	FAL	WLF	CAR	MU
2			163													12
3			1											2		
6			41													
7			119													
8			40													
9			54													
10			263													
11			115											1		
12			71									1				
13			42													
14			18													
15	1															
17			4													
18			17													
20			65													
21			40													

Appendix 5. Continued.

Date: 24/07/1984

Transect: B

Unit No.	Species														
	RTL	TS	CG	WPG	SG	UG	SC	OLD	UD	MER	RLH	GE	FAL	WLF	CAR	MU
22			153													
24			8													
28			40													
29			7													
31			7													
32			15													
33			226													6+2
34	1		84													
35			157													
36	2		148		135[2]											21
38			158											1		
39			77													
40			220		30+6[2]											1
41			173		22+6[2]											
42			184				12									
43			360	6	67											

Appendix 5. Continued.

Date: 24/07/1984

Transect: B

Unit No.	Species															
	RTL	TS	CG	WFG	SG	UG	SC	OLD	UD	MER	RLH	GE	FAL	WLP	CAR	MU
44			159		29[2]											7
45			32		18											
46			237		17											16+1
47			69													
48			45													
51			73													1
52			4											1		
53			23													
54			88		24									2		
55			103													1
56			131													
57			63													
58			9													
59			71													
60			25													
61			67													

Appendix 5. Continued.

Date: 24/07/1984

Transect: B

Unit No.	Species															
	RTL	TS	CG	WPG	SG	UG	SC	OLD	UD	MER	RLH	GE	FAL	WLF	CAR	MU
63			3													
64			9							1						
65			44													
66	2		18													
74															1	
76			16													
79	1		14													
80			8													
81			4	1												
83	2															
84													1P			
85					1											
86			14													
94					3											
95			4+6													
96			124+6													

Appendix 5. Continued.

Date: 24/07/1984

Transect: B

Unit No.	Species															
	RTL	TS	CG	WPG	SG	UG	SC	OLD	UD	MER	RLH	GE	FAL	WLF	CAR	MU
98			26													
99											1			8		
100	1															
101					10^2											
102			20		35	20										
103			12		182+15											
105			39		176+49											
107			98													
109			84													
111			65			10										
115			120													
116			53													
117			149^2		4											

Appendix Continued

Date: 25/07/1984

Transect: C

Unit No.	Species															
	RTL	TS	CG	WPG	SG	UG	SC	OLD	UD	MER	RLH	GE	FAL	WLF	CAR	MU
5			18		4						1					
6			34+3										1G			
7			16													
9			4													
10			7		1											
11										2						
12			122		14											
13			51													
14						12										
15			18													
16			96													
18			8													
19			21													
21											1					
24			71													
25			39													

Appendix 5. Continued.

Date: 25/07/1984

Transect: C

Unit No.	Species															
	RTL	TS	CG	WFG	SG	UG	SC	OLD	UD	MER	RLH	GE	FAL	WLF	CAR	MU
28			12													
29			14													
30			30													
31			17		2	30										
32		4+4	6													
34			379	4												
35			25		10+12											
36			63		23+25											
37	1	1	124		29	12				1						
38			73													
39			47		26											
43	1		8		4											
44					3+2											
49			31		17											
50			14		20											
51	2		80													

Appendix 3.1 Continued.

Date: 25/07/1984

Transect: C

Unit No.	Species															
	RTL	TS	CG	WFG	SG	UG	SC	OLD	UD	MER	RLH	GE	FAL	WLF	CAR	MU
53	2		14													
54	2															
55			20							4						
58			61													
59			50													
60	1		54													
61			95+8			2										
62			26												1	
65			57													
66			90													
67			8													
68			48													
69			28													
70			4													
71			19													
72			2													

Appendix 5. Continued.

Date: 25/07/1984

Transect: C

Unit No.	Species															
	RTL	TS	CG	WPG	SG	UG	SC	OLD	UD	MER	RLH	GE	FAL	WLF	CAR	MU
73			248	2												
74			125													
75			63													
76														1		
78	2		24													
79			11												1	

Appendix 5. Continued.

Date: 26/07/1984

Transect: D

Unit No.	Species														
	RTL	TS	CG	WFG	SG	UG	SC	OLD	UD	MER	RLH	GE	FAL	WLF	CAR	MU
1			67													
2			10													
3			12	2+4		5										
4			8													
5			15													
14			2													
15			12	7												
16			13			12										
17			12													
18			39							4						
19			70							14						
20			18													
22			58													
23			17							11						
24			140													
25			25							6			2?			
26			45													

Appendix 5. Continued.

Date: 26/07/1984

Transect: D

Unit No.	Species															
	RTL	TS	CG	WFG	SG	UG	SC	OLD	UD	MER	RLH	GE	FAL	WLF	CAR	MU
28			50													1
29			52													
30		2	2													
31			17													
32			4									1				
33			23		25[2]											
34			70+4													36
35			23													
36			100+20		2+2							1				1
37			130+5[2]													
38			153+5	18+8	7	4										
39			46		10+25											
40			20+8													
41			44+4		10+18											
42		3	200			20										
48			84													
49						20										

Appendix 5. Continued.

Date: 26/07/1984

Transect: D

Unit No.	Species															
	RTL	TS	CG	WFG	SG	UG	SC	OLD	UD	MER	RLH	GE	FAL	WLF	CAR	MU
50			27+4													
51			33	4												
52			96+2													
53			10													
54			8													
55											1					
56			26	4+6						2						
59			24+2													
60			43	4												
61			14							7						
62			7													
63																1
64			22													1
65														1		1
66										3				1		2
76		2+2														
77		2														

Appendix 5. Continued.

Date: 27/07/1964

Transect: E

Unit No.	Species															
	RTL	TS	CG	WFG	SG	UG	SC	OLD	UD	MER	RLH	GE	FAL	WLF	CAR	MU
14		1														
15				34								1			1	
16		2				23										
17		1														
24										1						
29										1						
39																7

Appendix 5. Continued.

Date: 28/07/1984

Transect: F

Unit No.	Species															
	RTL	TS	CG	WPG	SG	UG	SC	OLD	UD	MER	RLH	GE	FAL	WLF	CAR	MU
1																1
4																1
5												1				1
10								3		30						
11								30		6						
12										4						
14										30						
15												1				
16															1	
20												1			1	1
22																1
25												1				1
27										3						
29																1

Appendix 5. Continued.

Additional Sightings: A23 - 1 AL; D61 - 1 GB; D72 - 7 SD; D73 - 7 SD; E21 - 2 GB; F3 - 1M (female); F13 - 1 WLV, GG colony.

1 - on transect only.

2 - young present but could not be counted.

m - male.

? - species undetermined.

Appendix 6. Summary of goose body measurements (mm).

Specimen No.	1	2	3	4	5	6	7	8	9
Sex	M	F	M	F	F	F	M	F	M
Culmen 1	53.8	56.9	60.1	39.8	56.6	50.6	52.5	56.5	62.9
Culmen 2	63.0	62.7	69.4	51.7	66.3	58.1	64.0	64.8	70.5
Culmen Width	21.8	21.6	24.5	18.5	21.6	20.1	23.3	22.6	24.1
Tarsus	86.1	83.8	97.7	75.9	89.3	85.6	88.6	98.2	94.6
Tarsus Total	105.4	105.5	115.2	92.5	107.2	101.9	104.5	106.6	112.9
Mid-Toe	74.7	75.2	83.2	61.3	77.9	70.7	75.9	79.9	84.4
Mid-Tail	122	132	147	73	143	123	151	95	144
Flat Wing	302	329	344	309	339	309	381	365	374
9th Primary	137	147	161	172	175	159	214	214	196
6th Secondary	116	132	138	136	133	133	177	167	164
Total Length	853	855	902	763	865	-	884	853	885
Weight (Kg)	3.6	3.5	4.4	2.6	3.5	-	4.1	3.2	4.3

Appendix 6. Continued.

Specimen No.	10	11	12	13
Sex	M	M	?	M
Culmen 1	61.2	61.7	55.5	54.9
Culmen 2	70.7	71.0	64.9	64.3
Culmen Width	25.2	23.6	23.0	23.4
Tarsus	93.6	120.4	100.8	100.9
Tarsus Total	117.7	100.8	120.4	113.3
Mid-Toe	87.7	85.0	73.9	84.4
Mid-Tail	163	158	154	130
Flat Wing	439	407	411	453
9th Primary	243	223	257	278
6th Secondary	202	190	192	209
Total Length	965	962	881	852
Weight (Kg)	4.4	4.4	3.9	4.4